UNITED STATES PATENT APPLICATION

OF

Ki Hyung DO et al

FOR

WASHING MACHINE AND CONTROL METHOD THEREOF

[0001] This application claims the benefit of Korean Application No. 10-2002-0073895 filed on November 26, 2002, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a washing machine, and more particularly, to a method and apparatus for sensing an amount of laundry in a washing machine employing a pulse sensor coupled to a motor.

Discussion of the Related Art

[0003] Generally speaking, a washing machine, which may include pulsator-, stir-, and drum-types, is an apparatus for cleaning laundry by performing washing, rinsing, and dewatering steps according to a programmed cycle and a wash pattern appropriate for a given amount of laundry. At the outset of the washing step, an amount of laundry is placed in the washing machine, which senses the amount and supplies water accordingly, taking into consideration a wash command selected by a user. The supply of water continues until a predetermined level is reached, whereupon a motor is driven to begin the washing step and is accelerated to a predetermined speed. Shortly thereafter, as the laundry begins to absorb the water, the predetermined level initially drops according to the degree of absorption. The reduced level is sensed, and additional water is supplied to compensate for the amount of absorbed water.

[0004] FIG. 1 illustrates an apparatus for sensing an amount of laundry in a washing machine according to a related art. The apparatus includes a microcomputer 2, having an internal timer 2a, for controlling the overall washing machine system and specifically for determining a wash pattern in accordance with a laundry amount and a user command input

via a key input unit 1 and outputting a control signal to a load driver 3; a motor 4, driven by the load driver, for rotating in accordance with the control signal a drum (not shown) holding an amount of laundry; and an rpm detection means 5 for detecting the rotational speed of the motor as a revolutions per minute (rpm) signal provided to the microcomputer.

[0005] To sense the amount of laundry in the washing machine according to a related art, the time required for the motor 4 to rotate an empty drum and accelerate to the predetermined speed, as detected by the rpm detection means 5, is taken as a reference. The acceleration time, as measured by the internal timer 2a of the microcomputer 2, increases for larger and larger amounts of laundry and the corresponding levels of water. The laundry amount (load) is sensed using this principle, and the wash pattern is determined accordingly.

[0006] In the above method for sensing an amount of laundry in a washing machine according to the related art, however, in which an amount of additional water is supplied as the laundry absorbs the initially supplied water, the sensing of the amount of laundry is inconsistent, and therefore inaccurate, since various types of laundry exhibit varying rates and degrees of water absorption. That is, the laundry amount sensing apparatus of the related art cannot respond to the change in water level. As a result, the wash pattern is determined improperly, which degrades the washing performance of a washing machine.

SUMMARY OF THE INVENTION

[0007] Accordingly, the present invention is directed to a washing machine and control method thereof that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0008] An object of the present invention, which has been devised to solve the foregoing problem, lies in providing a washing machine and control method thereof, in which

a laundry amount is accurately sensed by calculating a revolution time and a corresponding pulse width generated during the time required for the motor to rotate from a static position to a predetermined position.

[0009] It is another object of the present invention to provide a washing machine and control method thereof, in which a wash pattern is properly set for any amount or type of laundry in the washing machine.

[0010] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent to those having ordinary skill in the art upon examination of the following or may be learned from a practice of the invention. The objectives and other advantages of the invention will be realized and attained by the subject matter particularly pointed out in the specification and claims hereof as well as in the appended drawings.

[0011] To achieve these objects and other advantages in accordance with the present invention, as embodied and broadly described herein, there is provided a washing machine comprising a motor for being driven, in response to a user command, to rotate a drum holding laundry; a pulse sensor for sensing a pulse generated by the driven motor and outputting a voltage signal indicative of a width of the pulse; and a microcomputer for sensing an amount of laundry based on at least an integration value derived from the voltage signal output from the pulse sensor. A value representing one revolution of the motor is stored in the microcomputer as a reference, and a timer is provided in the microcomputer for measuring a revolution time period required for the driven motor to reach a predetermined position of rotation, wherein the sensing of the laundry amount is further based on the revolution time period with respect to the reference value stored in the microcomputer. The motor is driven according to a wash pattern, which is set based on the sensed laundry amount.

[0012] In another aspect of the present invention, there is provided a method of controlling a washing machine. The method comprises steps of sensing a laundry amount according to a pulse generated when a motor is driven in response to a user command; and controlling a wash pattern according to the sensed laundry amount.

[0013] It is to be understood that both the foregoing explanation and the following detailed description of the present invention are exemplary and illustrative and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0015] FIG. 1 is a block diagram of an apparatus for sensing an amount of laundry in a washing machine according to a related art;

[0016] FIG. 2 is a block diagram of an apparatus for sensing an amount of laundry in a washing machine according to the present invention; and

[0017] FIG. 3 is a flowchart of a method for sensing an amount of laundry in a washing machine according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] Reference will now be made in detail to the preferred embodiment of the present invention, examples of which are illustrated in the accompanying drawings. Throughout the drawings, like elements are indicated using the same or similar reference

designations where possible.

[0019] FIG. 2 illustrates an apparatus for sensing an amount of laundry in a washing machine according to a related art. The apparatus includes a microcomputer 20, having an internal timer 20a, for controlling the overall washing machine system and specifically for determining a wash pattern in accordance with a laundry amount and a user command input via a key input unit 10 and outputting a control signal to a load driver 30; a motor 40, driven by the load driver, for rotating in accordance with the control signal a drum (not shown) holding an amount of laundry; and a pulse sensor 60 for sensing a pulse generated from one revolution of the motor and outputting to the microcomputer a voltage signal indicative of the pulse width. A value representing one revolution of the motor 40 is stored in the microcomputer 20.

[0020] Upon input of a wash execution command from the key input unit 10, the microcomputer 20 outputs the control signal to the load driver 30 to drive the motor 40, and a voltage signal is output based on a count of pulses (pulse width) sensed from the motor thus driven. The output voltage signal is used to determine whether the motor 40 has rotated to a predetermined position, e.g., a 2/5 revolution point, from which a revolution time is determined. The revolution time is measured by the internal timer 20a of the microcomputer 20 and is based on the time that the motor 40 required to rotate from a rotational starting point, i.e., a static position, to the 2/5 revolution point. The microcomputer 20 senses the amount of laundry in the rotating drum, based on the revolution time as measured by its internal timer 20a and the voltage signal output from the pulse sensor 60, and the sensed laundry amount is used to determine a wash pattern.

[0021] Referring to FIG. 3, illustrating a method for sensing an amount of laundry in a washing machine according to the present invention, once a wash execution command is

input via the key input unit 10, the microcomputer 20, in a step S31, outputs the control signal to the load driver 30 to begin driving the motor 40 and simultaneously initializes the internal timer 20a. Subsequently, it is determined in a step S32 whether the motor 40 has rotated to the predetermined position. Here, the microcomputer 20 references the stored value representing one revolution of the motor 40 and determines that the motor has rotated to the predetermined position if the voltage signal output from the pulse sensor 60 corresponds to two-fifths of the stored value.

[0022] It should be appreciated that the pulse width generated by the revolution of the motor 40 increases during a step S33 until the predetermined position is reached. Thus, the voltage signal output from the pulse senor 60 is integrated over time, producing an integration value for use by the microcomputer 20.

[0023] In a step S34, the revolution time and integration value are calculated at the 2/5 revolution point, and a sensed amount of laundry is determined based on the calculation. In a step S35, a wash pattern is set based on the sensed laundry amount.

[0024] It is important to note that, just prior to the execution of a wash command as described above, the washing machine of the present invention is in a static state. That is, the motor 40 is not being driven and the laundry is gathered in the bottom of the drum. Furthermore, it can be assumed the integration value, based on the sensed pulse width input and voltage signal output of the pulse sensor 60, increases uniformly per unit time. Therefore, a load force and the resulting revolution time are directly proportional to the amount of laundry, enabling an accurate determination of the laundry amount. Namely, as the load force increases in proportion to the laundry amount, so does the integration value resulting from the increased pulse width due to the longer time taken for reaching the predetermined position (the 2/5 revolution point).

[0025] As described above, the washing machine according to the present invention employs a pulse sensor coupled to a motor driven to rotate a drum holding an amount of laundry, to measure a pulse width generated by the driven motor, in order to sense the laundry amount accurately. The laundry amount is sensed by calculating a revolution time, based on the time required for the motor to travel from a static position to a 2/5 revolution point, and a corresponding integration value determined by a voltage signal output from the pulse sensor. Thus, the wash pattern can be properly set regardless of any change in water level due to an absorption of initially supplied water by the laundry.

[0026] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover such modifications and variations, provided they come within the scope of the appended claims and their equivalents.